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CELIAC PLEXUS BLOCKS PRIOR TO MEDIAN ARCUATE LIGAMENT RELEASE SURGERY: A CASE SERIES

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Background: Median arcuate ligament release (MALR) surgery is the most common procedure used to treat median arcuate ligament syndrome (MALS). Estimates of the success rate of this surgery range from 70-80%. Factors that affect the success of this procedure are not well understood.

Case Report: Nine patients with abdominal pain and a vascular ultrasound study suggestive of MALS underwent a celiac plexus block. All 9 continued to surgery and experienced ≥ 50% pain reduction in the upper abdomen postoperatively. Eight of these 9 patients had a positive celiac plexus block. One of 9 patients with a negative prognostic block experienced ≥ 50% pain reduction in the upper abdomen after surgery.

Conclusions: These data suggest that the accuracy of prognostic celiac plexus blocks in predicting successful MALR surgery is 89%. This can be compared to estimates of the success rate of surgery without prognostic blocks (70-80%).

Key words: Chronic abdominal pain, median arcuate ligament release surgery, median arcuate ligament syndrome, nerve block prognostic value, upper abdomen

BACKGROUND

Median arcuate ligament syndrome (MALS) describes intermittent gastrointestinal ischemia due to compression of the proximal celiac artery by the median arcuate ligament. It was first defined in 1963 by P.T. Harjola in the Annales Chirurgiae et Gynaecologiae Fenniae (1). Signs and symptoms correlate with the degree of ischemia and include postprandial epigastric pain, nausea, vomiting, and weight loss (2). The diagnosis can be made using color doppler ultrasonography, magnetic resonance imaging, and conventional angiography (3-4). Typical findings include elevated celiac artery velocities on ultrasonography and a "J-hook" conformation of the celiac artery on angiography.

Celiac plexus blocks, performed since at least 1914 (4), are commonly performed to relieve abdominal pain (5). The nerve block works by disrupting afferent visceral sensory fibers from the upper abdominal organs. The celiac plexus is located anterolateral to the aorta at the level of T12-L1 and can be blocked unilaterally or bilaterally with computed tomography, fluoroscopy, or endoscopic ultrasound guidance. In one study of 72 celiac plexus blocks for non-cancer related abdominal pain, 67% of blocks were effective with a mean duration of action of 51 days. In the same study, 7 out of 10 blocks specifically for MALS were effective (6).

Median arcuate ligament release (MALR) surgery is the most common procedure used to treat MALS. Due to the low incidence/prevalence of MALS, there are few known factors that predict success of MALR surgery (7).

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Patient selection is an important question because celiac artery compression is a normal variant in up to 24% of the population. Current estimates of the success rate of MALR surgery range from 70-80% (8). Prior to MALR surgery, we hypothesize that a pre-operative celiac plexus block with improvement in abdominal pain of at least 50% would confirm the diagnosis and increase the likelihood of surgical success.

CASE PRESENTATION

Between July 2019 and June 2021, 9 patients documented to have pain in the upper abdomen due to MALS as diagnosed by clinical exam and a positive vascular ultrasound study, received a prognostic celiac plexus block, and subsequently had MALR surgery. Eight patients were women. One was a man. The average age was 36 years. The average body mass index (BMI) was 26 kg/m^2. All 9 patients had vascular mesenteric ultrasound studies suggestive of MALS. The average duration of relief among the 8 patients with a positive diagnostic block was 1.5 months. The average duration of follow-up post-operatively was one year. Two of the 9 patients developed recurrent abdominal pain during the follow-up period (Table 1).

All 9 patients included in this review had abdominal pain, a vascular ultrasound study suggestive of MALS, and underwent a prognostic celiac plexus block. All 9 continued to MALR surgery and experienced ≥ 50% pain reduction in the upper abdomen after surgery. Eight of these 9 patients (89% true positive) had a positive prognostic celiac plexus block. One of 9 patients with a negative prognostic block experienced ≥ 50% pain reduction in the upper abdomen after surgery (11% false negative rate). In this small case series, a celiac plexus block had an 89% true positive rate, in predicting successful pain relief after MALR surgery. There were no false positive prognostic celiac plexus blocks and therefore no reportable specificity.

Celiac plexus blocks in these patients were performed using the retrocrural technique (9). Patients were positioned in the prone position on a procedure table. Local anesthesia was achieved using a 25-gauge, 1.5-inch needle and 1% lidocaine. Then a 22-gauge, 5-inch needle was guided using fluoroscopy at the L1 vertebral level to just anterior to the L1 vertebral body (Figs. 1-3). Contrast was injected to confirm correct placement of the needle and to confirm there was no vascular uptake (Fig. 4). Then 15 mL of 0.25% bupivacaine was injected. This was repeated on the opposite side. If the nerve blocks were > 50% effective, then these blocks were noted as positive. All patients included in this study ultimately went on to have MALR surgery. Post-operative patient records were reviewed to determine if MALR surgery provided > 50% pain relief and this was recorded as a binary yes/no.

Limitations

There are limitations to this study and its interpretation. Due to the low incidence/prevalence of MALS, reports on specific treatments, including this study, are

Table 1. Demographics and pain relief results after celiac plexus block and MALR.

Gender	Age	BMI	Duration of Pain (months)	Positive VAU	Pain relief after CPB	Duration (months)	MALR	Pain relief after MALR	Follow-up (years)	Recur
F	57	24	10	Yes	Yes	1	Yes	Yes	2	No
F	44	23	3	Yes	Yes	1	Yes	Yes	1	Yes
M	15	16	3	Yes	Yes	3	Yes	Yes	2	No
F	30	16	5	Yes	Yes	1	Yes	Yes	1	Yes
F	28	28	2	Yes	Yes	1	Yes	Yes	1	No
F	34	28	4	Yes	No	N/A	Yes	Yes	1	No
F	16	30	2	Yes	Yes	1	Yes	Yes	1	No
F	58	33	3	Yes	Yes	1	Yes	Yes	0.5	No
F	47	38	10	Yes	Yes	3	Yes	Yes	0.5	No
Avg:	36	26	5	N/A	N/A	1.5*	N/A	N/A	1	

*Average duration of pain relief among 8 patients with a positive diagnostic block

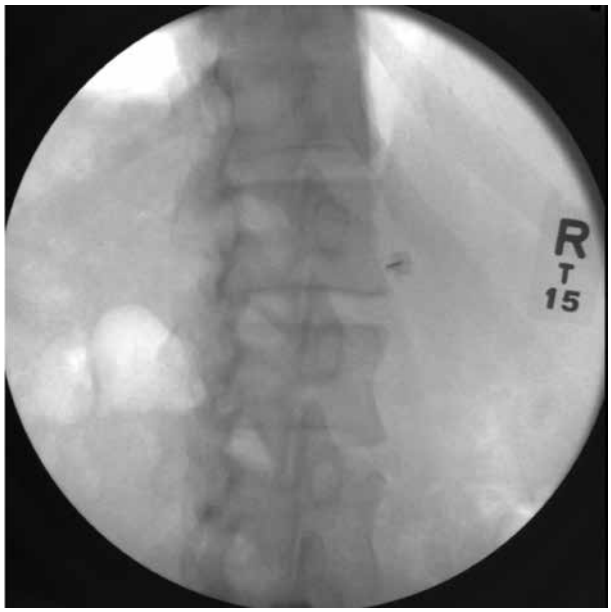

Fig. 1. Oblique view of a right-sided celiac plexus block with the needle directed to the plexus using a co-axial approach.

Fig. 2. Lateral view of a right-sided celiac plexus block with the needle directed just anterior and lateral to the L1 vertebral body.

typically small. In this case series, patients, physicians, and the researchers performing data analysis were not blinded. Without a blinded, control group receiving sham injections, there is a risk of bias.

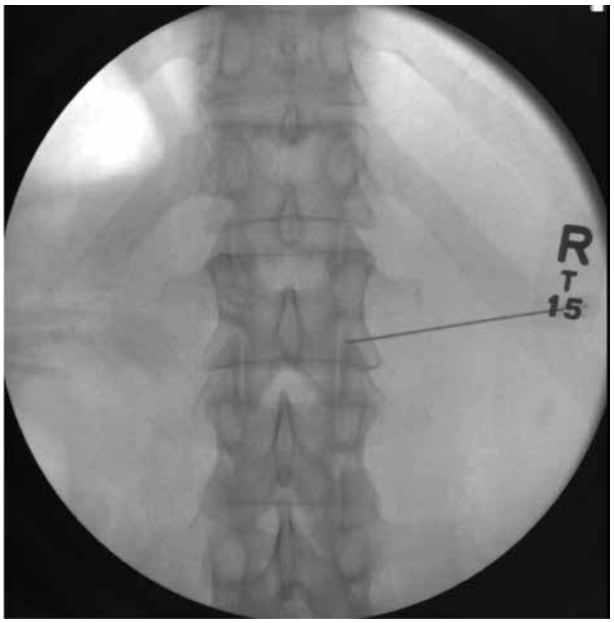

Fig. 3. Anterior-posterior view of a right-sided celiac plexus block with the needle directed just anterior and lateral to the L1 vertebral body.

Fig. 4. Anterior-posterior view of a right-sided celiac plexus block with contrast injected to confirm correct placement of the needle and to confirm nonvascular uptake.

CONCLUSIONS

This case series suggests that a pre-operative celiac plexus block, with improvement in abdominal pain of

at least 50%, can support the diagnosis of MALS and increase the likelihood of MALR surgery success. Here, we report 8 patients with a positive prognostic celiac plexus block that went on to have successful MALR surgery, defined as ≥ 50% pain reduction in the upper abdomen after surgery. These data suggest that the accuracy of prognostic celiac plexus blocks in predicting successful MALR surgery is 89%. This can be compared to estimates of the success rate of surgery without prognostic blocks (70-80%).

The post-operative follow-up period for these patients ranged from 6 months to 2 years, longer than most follow-up periods reported in studies on MALR surgery. Demographic results in this case series were similar to those of a 2020 review of data on robotic release of the median arcuate ligament (10). In that review, two-thirds of the patient cohort were women (8 out of 9 were women in this study), the average BMI was 27 kg/m^2 (the average BMI was 26 /m^2 in this study), and the mean age was 49 years (the mean age in this study was 36 years). The average duration of abdominal pain prior to the initial presentation in this case series is similar to that reported in other studies of chronic pain in western countries. One review showed that average time to diagnosis for chronic pain ranged from 4.6 months in the United Kingdom compared to 18 months in Mexico. The average duration of pain prior to presentation in this study was 5 months (11).

Eight of the 9 patients in this study had > 50% pain relief after a celiac plexus block, which is similar to the success rate reported in several other small studies (6,12,13). In one prior study, 7 out of 10 patients had celiac plexus blocks for MALS which were effective (6). Similarly, a case series of pediatric patients reported that 4 out of 4 patients had substantial abdominal pain relief after a celiac plexus block (12). These results also compare well to the efficacy rate of celiac plexus neurolysis, which in one meta-analysis reached 89% success 2 weeks after the procedure (13).

The duration of pain relief after celiac plexus block reported among patients in this study was 1.5 months. This is similar to a recent case series of 16 patients who underwent celiac plexus blocks with a median duration of relief of 21 days (14). Going forward, studies on the duration of action of autonomic nerve blocks, and the mechanisms underlying pain relief that lasts longer than the duration of action of local anesthetics would be useful. Positive celiac plexus blocks in our study were not associated with recurrence of pain after MALR.

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